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(54) METHOD AND DEVICE FOR EVALUATING DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method and a device for evaluating the quality of a moving picture of a display device objectively and numerically.
SOLUTION: A CCD 120 photographs a moving picture displayed on a display device 110 being an evaluation object as a time series still picture, a controller 200 captures the time series still picture and composites by superimposing the time series still pictures while shifting to tune them in the moving direction of the moving picture and evaluates the composite image by applying numeric conversion to luminance information and a cross-sectional plot form of the composite image.
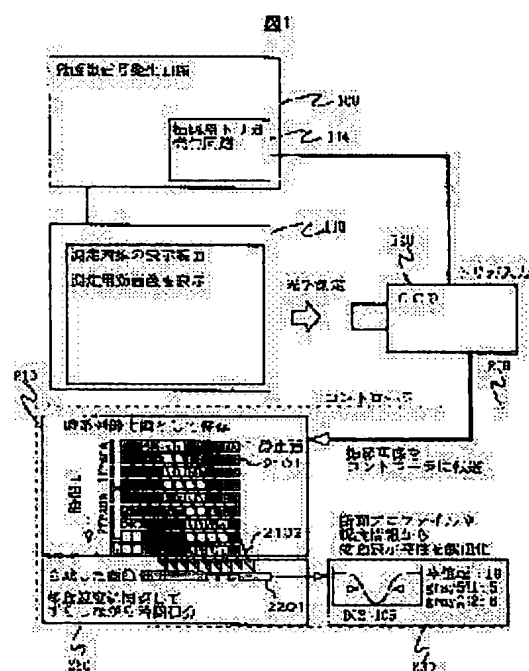
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CLAIMS

[Claim(s)]
[Claim 1] The assessment approach of the animation-display property characterized by to be the approach of evaluating the animation-display property of the display which displays a dynamic image, to photo the dynamic image currently displayed on the display of the measuring object as a time-series still picture, to compound in piles, shifting spatially two or more of said photoed time-series still pictures, and to evaluate by evaluating the physical quantity corresponding to the animation-display property used as said object for assessment using the information on said compound image.
[Claim 2] An image pick-up means to be equipment by which the animation display property of the display which displays a dynamic image is evaluated, and to photo the dynamic image of said display used as the object for assessment, Incorporate serially the static image photoed with said image pick-up means, and it piles up and compounds, shifting spatially two or more incorporated time series static images. It is assessment equipment of the animation display property which is equipped with the image-processing means which carries out the image processing of the this compound image, and is characterized by evaluating by said image-processing means evaluating the physical quantity corresponding to the animation display property which serves as said object for assessment using the information on said compound image.
[Claim 3] It is assessment equipment of the animation display property characterized by evaluating either [at least] the luminance distribution of said compound image, or a cross-section brightness profile as physical quantity corresponding to the animation display property that said image processing system serves as said object for assessment in assessment equipment according to claim 2.
[Claim 4] It is assessment equipment of the animation display property which it shifts when compounding displaying the dynamic image which the display for [said] assessment is moving as an image for the nature assessment of an animation in assessment equipment according to claim 2 or 3, and shifting said photoed time series image, and is characterized by an amount being equal to the amount corresponding to said passing speed within the photography image.
[Claim 5] The image which the display for [said] assessment shows in assessment equipment according to claim 4 and which moves is assessment equipment of the animation display property characterized by displaying fixed brightness between fixed width of face to the migration direction.
[Claim 6] The image which the display for [said] assessment shows in assessment equipment according to claim 4 and which moves is assessment equipment of the animation-display property characterized by to display brightness fixed in other fields which have the field of the luminance distribution which changes in the shape of [of the single period isolated between fixed width of face] a wave, and are located before and behind this field to the migration direction.
[Claim 7] The image which the display for [said] assessment shows in assessment equipment according to claim 4 and which moves is assessment equipment of the animation display property characterized by having the luminance distribution which has a fixed period and changes in the shape of [continuous] a wave to the migration direction.
[Claim 8] Assessment equipment of the animation display property which considers the display-control signal of the display for [which shows the image for the nature assessment of an animation in assessment equipment according to claim 2 to 7 / said] assessment as an input, and is characterized by having further the trigger output circuit which outputs the trigger signal for determining the photography timing of said image pick-up means.
[Claim 9] It is assessment equipment of the animation display property characterized by the photography timing of said time series still picture or the output timing of the trigger signal of said trigger output circuit be the timing from which the static image which 1 screen rewriting period of the display for [said] assessment and the synchronization are taken , and was photoed is the time amount of 1 for an integer of 1 rewriting period , and serves as regular intervals in assessment equipment according to claim 8 .
[Claim 10] The integral value which divides said 1 rewriting period in assessment equipment according to claim 9 is assessment equipment of the animation display property characterized by being the numeric value from which the time amount of 1 for an integer of said 1 rewriting period turns into time amount not more than 3m second.
[Claim 11] The integral value which divides said 1 rewriting period in assessment equipment according to claim 9 or 10 is assessment equipment of the animation display property characterized by being twice [more than] the value of the movement magnitude per 1 rewriting period of the dynamic image which the display for [said] assessment displays (pixel number).
[Claim 12] Assessment equipment of the animation property characterized by either the exposure time of each of said time series still picture and the exposure time of said image pick-up means being less than [3m second] in assessment equipment according to claim 2 to 11.
[Claim 13] An image pick-up means to be equipment reproducing the dynamic image displayed on the display perceived by human being's eyes, and to photo the dynamic image currently displayed on said display used as the object for assessment, Rendering equipment of the dynamic image characterized by having an image-processing means to reproduce the dynamic image perceived by human being's eyes by piling up and compounding, incorporating the static image photoed with said image pick-up means on two or more sheets time series targets, and shifting spatially these two or more time series static images that were crowded picking.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the method of evaluating the animation display property of a display especially, and assessment equipment about the assessment approach of a display, and assessment equipment.
[0002]
[Description of the Prior Art] It is becoming clear that the animation display property of these displays differs from the display using the conventional CRT in recent years as LCD, PDP, etc. spread as a display. This originates in LCD and PDP being hold mold displays to the conventional CRT being an impulse mold display.
[0003] About the approach of evaluating such an animation display property of an impulse mold display and a hold mold display, and its animation display property, it is carried in detail by Shingaku Giho, EID 96-4, and pp.19-26 (1996-06), for example. According to this, there is a method of the organoleptic test by human being's subjective judgment estimating an animation display property, and evaluating an animation display property in five steps.
[0004]
[Problem(s) to be Solved by the Invention] However, in the assessment using the above human beings' organoleptic test, since only five-step assessment was performed, delicate assessment or objective rating were not completed and the numerical target for the improvement in the nature of an animation etc. was not able to be determined. Moreover, costs, time amount, etc. were cutting in many — many strict maintenance of a measurement environment and manpower of a test subject must be collected.
[0005] It was made in order that this invention might solve such a problem, and management by the numerical target aims at offering the easy assessment approach of an animation display property, and assessment equipment.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned object, in this invention, the dynamic image currently displayed on the display for assessment is photoed as a time series still picture. The dynamic image perceived by human being's eyes by piling up and compounding, shifting said two or more photoed time series still pictures is reproduced. The physical quantity for evaluating an animation display property is evaluated using the information on the this compound image, for example, the information about the luminance distribution of a synthetic image, or the configuration of a cross-section brightness profile.
[0007]
[Embodiment of the Invention] The animation display characterization equipment by this invention is set in the 1 operation gestalt. The photography component with shutter ability in which random trigger actuation is possible (CCD), The image-processing controller which captures the image photoed with the photography component (CCD), and carries out the image processing of the image which piled up, shifting two or more captured images, and was compounded, The display-control signal of the display of the measuring object which shows the image for the nature assessment of an animation is considered as an input. It consists of trigger output circuits which output a trigger output to the trigger input of a photography component (CCD). It is constituted so that the image which piled up and compounded the dynamic image displayed on the display for assessment while taking a photograph by said photography component and shifting by said image-processing controller, and its cross-section plot form may be made into an assessment numeric value.
[0008] In order that there may be neither the need of improving a measurement environment strictly, nor the need of assembling many test subjects according to this invention, costs and time amount for measurement are short, and high numerical assessment of objectivity is attained with the high degree of accuracy beyond the five-step assessment by organic-functions assessment.
[0009] Hereafter, the animation display property equipment of this operation gestalt is explained more concretely.
[0010] The block diagram of the assessment equipment of the animation display property in this operation gestalt is shown in drawing 1 . This animation display characterization equipment is equipped with the dynamic-image signal generating circuit 100, CCD120, and a controller 200, and is constituted.
[0011] The dynamic-image signal generating circuit 100 generates the photography trigger doubled with measurement timing in the trigger generating circuit 104 for photography in the circuit, and is supplied to CCD120 while it supplies the picture signal and control signal of the dynamic image for measurement to the display 110 of the measuring object.
[0012] By the supplied photography trigger, CCD120 photos all or a part of viewing areas of an indicating equipment 110 shown the dynamic-image table, and transmits the photoed image data to a controller 200 serially.
[0013] A controller 200 is realized by performing the program corresponding to processing which is explained below in the computer system of the common knowledge equipped with CPU, memory, and an I/O means.
[0014] By the controller 200, the image data transmitted from CCD120 is first saved as a time series still picture (time series still picture preservation block 210). Here, each rectangle field 2101 has illustrated one still picture, respectively. It is not necessary to be the image shown in all the viewing areas of a display as a still picture which should be acquired, and as long as it is displaying some dynamic images [at least], you may be the image in a viewing area shown in the field in part.
[0015] Next, it compounds shifting spatially a series of saved time series still pictures so that it may align with the migration direction of a dynamic image, and movement magnitude, and the synthetic image 2201 is created (time series ******** carrying out synthetic block 220). The luminance distribution of the synthetic image 2201 is searched for by applying the pixel value of the field where each

still picture corresponds along with the arrow head 2102 corresponding to the passing speed of the dynamic image shown all over drawing. For details, an example is given and mentioned later.

[0016] Thus, the obtained synthetic image is viewed while human being follows a dynamic image, and it is generated so that it may become almost equal to the recognized image. With this operation gestalt, the numeric value as an animation display property is analyzed from the section profile and brightness information of this synthetic image, and it is asking (numerical-analysis block 230).

[0017] Furthermore, in order to explain a detail, the block diagram of the dynamic-image signal generating circuit 100 is shown in drawing 2 . In the dynamic-image signal generating circuit 100, in accordance with the resolution and frequency characteristics of a display 110 of the measuring object, a dot clock frequency and resolution are set up and a dot clock, a horizontal synchronization, a Vertical Synchronizing signal, etc. are generated from the dot clock generating circuit 101 or the control signal generating circuit 102. Next, the dynamic-image signal for measurement is generated in the dynamic-image signal generating circuit 103 using these control signals.

[0018] With this operation gestalt, three patterns which carry out horizontal scrolling with constant speed were prepared as a dynamic image for measurement. This is shown in drawing 3 .

[0019] A pattern (1) is the vertical bar poor-applied with fixed continuous tone gradation into background gradation. If a bar scrolls in a longitudinal direction and reaches short section of one of the two to background gradation, scrolling will be resumed from the other end. Although background gradation is white and continuous tone gradation has become black in drawing 3 , the breadth of background gradation, continuous tone gradation, and a bar, the passing speed of scrolling, etc. can be changed as a measurement image parameter. Especially passing speed is an important parameter and the number of migration pixels per 1 rewriting period (ppf:Pixel Per Frame) defined it with this operation gestalt.

[0020] Next, the pattern (2) is changing continuously [the continuous tone part of a pattern (1)] to the shape of a wave (solitary wave) of one period. At drawing 3 , the core of a wave serves as [background gradation] black in white. Similarly the phase of background gradation or a wave, width of face, a scroll rate, etc. can change.

[0021] At the last, the wave of one period of a pattern (2) becomes continuous, and the background of a pattern (3) is lost.

[0022] In addition, the pattern used by this invention is good also as a configuration which sets up the configuration of a pattern, brightness, a color, gradation, the migration direction, passing speed, etc. according to the display property which is not limited to the above-mentioned pattern and set as the object of assessment.

[0023] In the assessment equipment of this operation gestalt, although either of three kinds of above patterns is indicated by the animation (scrolling), when human being views these scrolling displays, human being's eyes are looking at the display, following to compensate for scrolling. In this case, it is the image of the result of having carried out time quadrature of the brightness, shifting a location, moving to scrolling in accordance with the image which human being recognizes.

[0024] Namely, what is necessary is to photo continuously the image which the display shows, and just to compound, shifting in the scrolling direction, in order to reproduce the image perceived by this human being's eyes. if the period (sampling period) of the photography at this time considers that one half of 1 rewriting periods (one frame) is the need (Nyquist rate) at least, and the time resolution of human being's eyes is 1 / about 300 seconds further — about 3 — it is desirable that it is m or less seconds. Since one frame of a display is made into 16.6 m seconds (60Hz) with this operation gestalt, it is desirable to divide and photo one frame at equal intervals to 6 or more ****s.

[0025] By the way, a CCD camera with a photography frequency of 360Hz or more is required to carry out 6 times or more of seriographies within the same frame. Since it became that to which the number of pixels was restricted, in this operation gestalt, such a high-speed CCD camera detected the frame from which a display pattern returns to the same location at the time of scrolling animation display like drawing 3 , and it presupposed it that six photography or more is carried out on a different frame in time which displays the same image, changing timing.

[0026] A trigger required for the above photography is generated from the trigger generating circuit 104 for photography. The block diagram of this trigger generating circuit 104 for photography is shown in drawing 4 .

[0027] In the trigger generating circuit 104 for photography, it is the 1/n frame counter 131, the dot clock counter 132, and a comparator 135, and the 1/n timing in the case of taking a photograph n times to one frame is outputted. The dot clock counter 132 is a counter which has counted the dot clock of an one-frame period. When the output value of this dot clock counter 132 is in agreement with the output value of the 1/n frame counter 131, the output of a comparator 135 just becomes. The 1/n frame counter 131 holds the value which made the interior the number of dot clocks of one frame 1/n, and since only the value counts up an output value whenever it takes a photograph once, it can always output the continuation timing within a frame.

[0028] Next, it detects whether the scrolling location of an animation scrolling display has returned to the original location with the scrolling measuring-point counter 133, the scrolling present location counter 134, and the comparator 136. The scrolling present location counter 134 has counted the location which is scrolling now by adding scrolling movement magnitude for every vertical synchronization. On the other hand, the scrolling measuring-point counter 133 starts scrolling, the scrolling location when taking a photograph first is held, and when both output is in agreement, the output of a comparator 136 just becomes.

[0029] When the output of the above two comparators just becomes in both, the output of AND circuit 137 serves as forward, and the output trigger for photography is outputted. When the count of the 1/n frame counter 131 counts up n times and advances, in order that the scrolling measuring-point counter 133 may count up only the number of pixels for passing speed and may show the following scrolling measuring point, the continuity of inter-frame photography is also maintained.

[0030] Thus, since the trigger outputted from the trigger output circuit 104 for photography serves as timing which changes with passing speed or photography numbers of partitions n in a frame, the CCD camera in which a shutter is possible is used for CCD120 by the random trigger from the outside, and it is carrying out the exact shutter ring by the trigger from the outside.

[0031] Moreover, CCD of the progressive scanning method which photos a full screen collectively as a photography method of CCD is used. As for the exposure time (shutter time amount), it is desirable that they are 1 / 300 seconds or less since the time resolution of human being's eyes is about 1 / 300 seconds as stated above, and the exposure time is made into 1 / 500 seconds with this operation gestalt.

[0032] Next, processing by the controller 200 is explained to a detail. The following explanation explains the example measured by the above-mentioned dynamic-image signal generating circuit 100 and above-mentioned CCD120, using a liquid crystal display as a display 110 of the measuring object. In addition, the animation display is used as the pattern (1) of black poor coating at the white background.

The image which photoed the display when displaying without scrolling this pattern (1) (still picture display) by CCD120 is shown in drawing 5 . The width of face of the bar of this pattern (1) is 32 pixels.

[0033] One of the static images which photoed continuously the display when scrolling this pattern (1) by passing speed 8ppf (pixel per frame) by CCD120 is shown in drawing 6 . By this controller 200, the above still pictures are acquired serially and saved at the time series still picture preservation block 210.

[0034] Halftone is shown to right and left of the bar of a pattern (1) according to the delay of an electrical-potential-difference-brightness response of liquid crystal by the still picture shown in drawing 6 . In this example, since the pattern is scrolling from the right to the left, the halftone field on the right of a black poor pattern should change to white gradually, and the left halftone field should change to black gradually.

[0035] In addition, in this example, the photography number of partitions n in a frame photoed the time series still pictures of a total of 32 sheets (two frames) including this drawing 6 as n= 16. Although it was desirable that it is six or more as mentioned above as for the photography number of partitions in a frame, since it was desirable that it is twice [more than] the movement magnitude, it was further referred to as n= 16 from the point of precision.

[0036] When this time series still picture was observed continuously, signs that the black poor pattern moved surely, changing halftone from the right to the left were able to be seen. In this case, the pattern of halftone of the still picture of the n-th sheet and the n+16th sheet is the same, and only locations differ by the movement magnitude of one frame. In this example, since it is uniform movement magnitude 8ppf, 8 pixels and a location will move on the display of the measuring object. Since this migration is pursued and the fixation point always shifts, human being's eyes are compounding each image, shifting in the scrolling direction according to that time amount timing in a frame for every still picture of a time series still picture, and become possible [reproducing the image perceived by human being's eyes].

[0037] That is, like this example, in movement magnitude 8ppf, 1 pixel of still pictures of 2/16 of timing is shifted, 4 pixels of still pictures of 8/16 of timing are shifted, 7 pixels of still pictures of 14/16 of timing are shifted, and it is that there is the need of compounding a case with 16 frame interior division rates. Thus, the compound image is shown in drawing 7 . By the controller 200 of this operation gestalt, synthetic processing which carried out [time series ********] and was mentioned above with the synthetic block 220 is carried out.

[0038] Dotage by the delay and the hold mold indicating equipment of a speed of response joined the synthetic image of drawing 7 , and it has faded very much in it because the image which should look being the same as that of drawing 5 which is a still picture scrolls. Observation by viewing is also actually observed so that almost equally to this. This is degradation of the display property (animation display property) of an animation display. Such degradation has change with passing speed, and is understood that degradation is so large that passing speed is large. With this operation gestalt, in order to evaluate degradation of such an animation display property numerically, the brightness information and the cross-section brightness profile of this synthetic image are analyzed and evaluated with the numerical-analysis block 230 of a controller 200.

[0039] The cross-section brightness profile of the synthetic image when scrolling the above-mentioned pattern (1) with the scrolling passing speed 1, 2, and 4 and the movement magnitude of 8ppf is shown in drawing 8 . passing speed becomes large — alike — following — a halftone field — breadth and a small-fire injury — it turns out that it becomes large. An animation display property can be evaluated by analyzing this cross-section brightness profile.

[0040] First, the ratio of the white intensity level of this cross-section brightness profile and a black intensity level can be evaluated as a dynamic-contrast ratio (Dynamic-C.R.) as compared with the contrast ratio of a still picture. This is shown in drawing 9 . From the graph of drawing 9 , it was observed that Dynamic-C.R. falls as passing speed became large. The more this has the quick passing speed of an animation, the more it is that the contrast value of the display will fall.

[0041] Moreover, the halftone area size of right and left of a cross-section brightness profile and half-value width can also be evaluated. These are shown in drawing 10 . Drawing 10 shows the width of face of the field of the halftone which appears before and after the half-value width of the cross-section brightness profile of a pattern (1), and a pattern (1), and relation with passing speed. In addition, the number parameter of pixels of a graph axis of ordinate expresses the width of face on the image pick-up screen of CCD120, and the number of pixels on the display screen is supported. the halftone area size of this graph to right and left — passing speed — large — becoming — it is proportional — large — becoming — more — a small-fire injury — it is shown that it is large. Moreover, it has observed that half-value width became small as passing speed becomes large.

[0042] With this operation gestalt, although the pattern (1) was used for the example as an animation display pattern, even when a pattern (2) and a pattern (3) are used, same assessment can be performed. Especially a pattern (2) and a pattern (3) fit assessment of a Dynamic-C.R. property in order for the value of Dynamic-C.R. to turn into a severer value and to approach real images, such as natural drawing, also in pattern.

[0043] Moreover, when the source of a picture signal general-purpose as a dynamic-image signal generating circuit is used, the trigger generating circuit 104 for photography is installed between the source of a picture signal, and the indicating equipment of the measuring object, and you may make it input data, such as animation movement magnitude, although the trigger generating circuit 104 for photography was constituted from this operation gestalt in the dynamic-image signal generating circuit 100.

[0044] Furthermore, evaluation of Dynamic-C.R. of the animation display property in this operation gestalt, halftone width of face, half-value width, etc. can be evaluated like the above about other parameters set up in order [in the border area of the evaluation criteria which are examples, originate in the animation display property of a display and may appear, for example, a dynamic image,] to fade and to detect **** change etc.

[0045] With this operation gestalt, by as mentioned above, the thing to be with a dynamic-image signal generating circuit, CCD, and a controller Since the image perceived by human being's eyes is reproducible, in order to carry out organoleptics Since costs and time amount for measurement are short in order that there may be neither the need of improving a measurement environment strictly, nor the need of assembling many test subjects, and the brightness information and the cross-section brightness profile of an image are evaluated Since the numerical assessment beyond the five-step assessment by organic-functions assessment is possible, management by the numerical target is easy and the assessment approach of an animation display property and assessment equipment whose assessment of high degree of accuracy is attained can be offered.

[0046]
[Effect of the Invention] Since costs and time amount for measurement are short in order that there may be neither the need of

improving strictly the measurement environment for carrying out organoleptics by introducing this invention as a means to evaluate the animation display property of a display, nor the need of assembling many test subjects, and the numerical assessment beyond the five-step assessment by organic-functions assessment is possible, management by the numerical target becomes easy.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the animation display performance-evaluation equipment of the indicating equipment in 1 operation gestalt of this invention.
[Drawing 2] The block diagram of the dynamic-image signal generating circuit 100 in the operation gestalt of drawing 1 .
[Drawing 3] The explanatory view explaining the dynamic-image pattern for measurement in the operation gestalt of drawing 1 .
[Drawing 4] The block diagram of the trigger generating circuit for photography in the operation gestalt of drawing 1 .
[Drawing 5] The explanatory view showing the static image photoed with the assessment equipment of the operation gestalt of drawing 1 .
[Drawing 6] The explanatory view showing one example of the dynamic image continuously photoed with the assessment equipment of the operation gestalt of drawing 1 .
[Drawing 7] The explanatory view showing the image compounded while shifting the dynamic image continuously photoed with the assessment equipment of the operation gestalt of drawing 1 .
[Drawing 8] The graph which shows the cross-section brightness profile of the synthetic image in the assessment equipment of the operation gestalt of drawing 1 .
[Drawing 9] The graph which shows one example (Dynamic C.R.) of the animation display characterization result in the assessment equipment of the operation gestalt of drawing 1 .
[Drawing 10] The graph which shows one example (halftone width of face, half-value width) of the animation display characterization result in the assessment equipment of the operation gestalt of drawing 1 .
[Description of Notations]
100 — A dynamic-image signal generating circuit, 101 — A dot clock generating circuit, 102 — Control signal generating circuit, 103 — A dynamic-image signal generating circuit, 104 — The trigger generating circuit for photography, 110 — The display of the measuring object, 120 — CCD, 131 — A 1/n frame counter, 132 — Dot clock counter, 133 — A scrolling measuring-point counter, 134 — Scrolling present location counter, 135 — a comparator, a 136 — comparator, a 137 — AND circuit, and 200 — a controller, a 210 — time series still picture preservation block, 220 — time series ******** et al. — carrying out — a synthetic block and a 230 — evaluation analysis block.

[Translation done.]